NPSAW-91-002

NAVAL POSTGRADUATE SCHOOL

Monterey, California

AN EMPIRICAL ANALYSIS OF A

SUBMARINE MOTION MODEL

by

R. N. Forrest and J. N. Eagle

August 1991

Prepared for:
Naval Air Development Center
Johnsville, PA 18974

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This report was prepared for the Naval Air Development Center, Johnsville, Pennsylvania, and funded by the Naval Postgraduate School.

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UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S) NPSAW-91-002	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION Naval Postgraduate School 6b OFFICE SYMBOL (If applicable) AW	7a NAME OF MONITORING ORGANIZATION Naval Air Development Center
6c ADDRESS (City, State, and ZIP Code) Monterey, CA 93943-5000	7b ADDRESS (City, State, and ZIP Code) Johnsville, PA 18974
8a NAME OF FUNDING/SPONSORING ORGANIZATION Naval Postgraduate School 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER O & MN, Direct Funding
8c ADDRESS (City, State, and ZIP Code) Monterey, CA 93943-5000	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)
AN EMPIRICAL ANALYSIS OF A SUBMARINE MOTION MODEL

12 PERSONAL AUTHOR(S)
R. N. Forrest and J. N. Eagle

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Technical	FROM _____ TO _____	1991 August	97

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Submarine Motion Models ASW Tactical Decision Aids Random Tracks

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The report describes an empirical analysis of a submarine motion model that has been used in an ASW tactical decision aid. The primary conclusion from the analysis is that there are tactically reasonable submarine motions that may not be adequately described by the model.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL J. N. Eagle	22b TELEPHONE (Include Area Code) 408-646-2654 22c OFFICE SYMBOL AW

The programs in this report are presented without representation or warranty of any kind.

Table of Contents

I. Introduction

This report describes an empirical analysis of a motion model that has been used to generate random submarine tracks for an ASW tactical decision aid. The model describes a submarine's motion as a series of transitions between the square cells of a grid that covers a defined operating region. A 3 X 3 transition matrix is associated with each cell of the grid which determines the submarine's transitions from a cell. The set of transition matrices define a Markov process. Despite its discrete nature, this Markov track generating process has been called a diffusion process in antisubmarine warfare tactical decision aid literature. The transition matrices are determined by tracks generated by an auxiliary stochastic process that is presumed to be of higher fidelity but more costly to implement than the Markov process.

The auxiliary track generating process that was used in the analysis is a random tour process that was developed to generate operationally realizable submarine tracks. The process, which is described in detail in Reference 1, generates random tracks that have specified end points and a specified length or, for a submarine with a constant track speed, a specified transit time. The auxiliary process is implemented by the program that is listed in Appendix 1.

The auxiliary tracks are the basis for the generation of two types of diffusion transition matrices by a procedure described in Section II. The first type, called static transition matrices, are the transition matrices that define the subject Markov motion

model. A static transition matrix is associated with each cell of the operating region grid. The second type, called dynamic transition matrices, define an alternate Markov motion model. This model differs from the subject model in that the transition matrix associated with a cell depends on the number of transitions that have taken place in the motion, that is, it is time dependent.

The auxiliary tracks are also the basis for the generation of a set of maps that describe a submarine's position at a sequence of equally spaced times that are determined by a fixed time step. The number of times a cell is occupied at the end of a time step divided by the number of tracks is an estimate of the probability that the submarine was within the cell at the time step. For this reason, such maps are called probability maps in the following discussion.

Tracks generated by the subject static diffusion Markov process and those generated by the alternate dynamic diffusion Markov process also can be used to generate probability maps. Some differences between the three track generating processes is evident by a comparison of the random tour probability maps, the dynamic diffusion probability maps and the static diffusion probability maps that are shown on the following pages.

II. The Transition Matrix Generation Procedure

The transition matrices that are used in the analysis were determined by the program listed in Appendix 1. In the program, a random tour track is generated by a submarine moving with constant speed between two points located in a plane. The points lie on the x-axis of a rectangular coordinate system whose origin is midway between the points. Lines parallel to the x-axis and lines parallel to the y-axis define a grid of square cells in the plane. (For examples of the program geometry, see Section V.) In the following discussion of the transition matrix determination procedure, grid cells are identified by the rectangular coordinates of their centers.

During its motion, the cell occupied by the submarine is determined at a sequence of times separated by a fixed time step. From this determination, transition matrices are constructed as follows: First, the cell that is occupied is determined for each time step. For I = 1 to NS (the number of time steps), if cell (L0, M0) is occupied by the submarine at the end of the I-1st time step, at the end of Ith time step, the submarine will be in a cell (L0 + N, M0 + K) where N = -1, 0, or 1 and K = -1, 0, or 1. In this case, 1 is added to the (N,K) element of a 3 X 3 transition matrix associated with cell (L0,M0) for time I-1. The elements of this matrix are stored in an array MT(N, K, L0, M0, I-1). In addition, 1 is added to the (N,K) element of a second 3 X 3 transition matrix associated with cell (L0,M0). And, the elements of this matrix are stored in an array MTS(N, K, L0, M0). By

repeating this procedure for each random tour track, and dividing the resulting matrix elements by the number of tracks, the elements of the 3 X 3 matrix in the array MT become estimates of the elements of the dynamic transition matrix, and the elements of the matrix of the 3 X 3 matrix in the array MTS become estimates of the elements of the static transition matrix.

The transition matrices and the probability maps used in the analysis were generated from 10,000 random tour tracks. Since the time step duration is equal to the cell side length divided by the track generating submarine's speed; during a time step, the submarine will either transition to an adjacent cell or remain in its current cell. This results in a transition matrix of nine elements, each element giving the probability of a transition.

III. Some Comparisons of the Track Generating Processes

The dynamic and static transition matrices of the two discrete Markov track generating processes generate tracks that are random but differ in fine structure from those generated by the random tour process. This is not surprising considering the loss of information that occurs in their generation. Since the Markov motion is from a cell center to the cell center or a neighboring cell center, only nine motions are possible. In particular, for a submarine that moves with constant track speed, this results in a loss of position and velocity information. Relative to the auxiliary track generating process, the diffusion tracks no longer satisfy the constraints of constant speed, specified length and specified final end point.

The fidelity of the diffusion tracks could be improved in two ways: First, by reducing the duration of the time step and consequently the size of the cells, less positional information would be lost. Second, by generating a velocity (direction of motion) distribution for each cell and each time step, transition matrices could be constructed that would be more descriptive of the random tour motion and less directional information would be lost.

IV. Conclusions

The primary conclusion from the analysis is: For discrete Markov processes whose state space if current location and time, there are tactically reasonable submarine motion scenarios that can not be closely approximated by tracks generated with static transition matrices but can be closely approximated with dynamic transition matrices. There are, however, other tactically reasonable submarine motion scenarios that can not be closely approximated with either procedure. In what is possibly the simplest example of this, consider a submarine that moves among three adjacent cells labeled 1, 2 and 3. Suppose the submarine chooses either path (1,2,3) or path (3,2,1), each with probability .5. Given the submarine is in cell 2, the probability that the submarine will transition to cell 3 is dependent on its previous location as well as on its current location. Consequently, a Markov process whose state space is only current position and time can not describe its motion.

For the random tour scenarios that were investigated, dynamic diffusion tracks were found to rather closely emulate the random tour tracks from which the dynamic transition matrices were derived. In addition, and in contrast to the static diffusion tracks, the dynamic diffusion tracks generated probability maps that duplicated the random tour probability maps. Although the static tracks were generally similar in appearance to the dynamic diffusion tracks, they did not uniformly terminate at the random tour track final end point. However, for the chosen scenario,

approximately half of the tracks did do so as is evident from the static diffusion probability maps that are shown in Section V.

The divergence between the dynamic diffusion probability maps and the static diffusion probability maps is even more evident when the initial point and final point of a track coincide. The explanation for this is the variation of the dynamic transition matrices with time. That is, the same cell must perform a "submarine expansion" function early in the motion and a "submarine contraction" function towards the end. But, when the starting and ending cells are distant from each other, the function of any cell does not change significantly with time. That is, cells near the start cell are for always for "expansion" and those near the end cell are always for "contraction."

The random tour process on which the empirical analysis is based was chosen to amplify the divergence between the random tour tracks, the dynamic diffusion tracks and the static diffusion tracks. The significance of this divergence for a tactical decision aid incorporating a motion model based on static transition matrices will depend on the desired applications of the decision aid. For example, it might be less significant if the location of the final end point of a submarine track were chosen randomly or if computer memory or processing speed limited modeling choices.

The figures in Section V that follows show probability maps and tracks generated by the random tour process, the dynamic Markov process transition matrices, and the static Markov process transition matrices. These figures illustrate the relative effectiveness of the dynamic and static Markov motion model in emulating the random tour motion model. The diffusion tracks that are shown were generated with 17 diffusions. This results in tracks that are approximately equal in length to the length the random tour tracks.

V. The Analysis Program Output

The figures, tables and maps that follow are based on data generated by the analysis program that is listed in Appendix 1. They provide the basis for the empirical analysis.

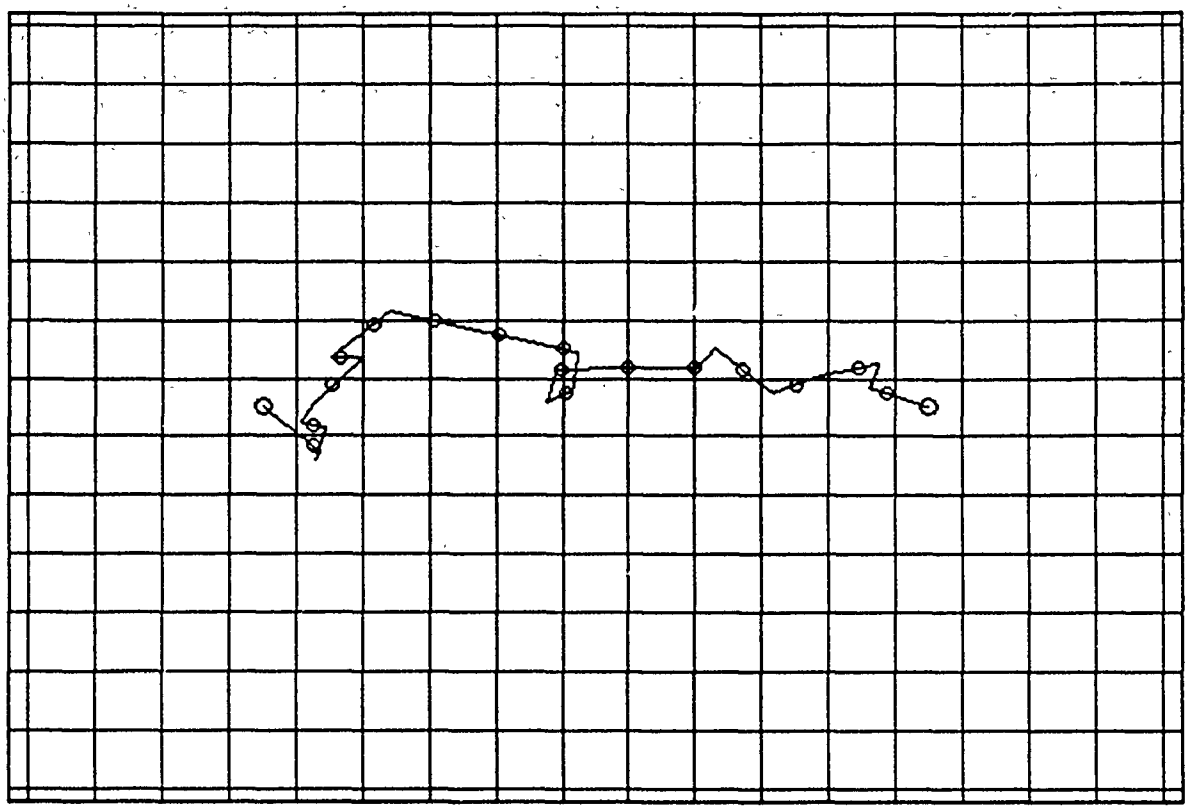

Figure 1. A track generated by a random tour process used in the analysis. The larger circles on the left and the right are the initial and final point of the track. The smaller circles are track positions at step times.

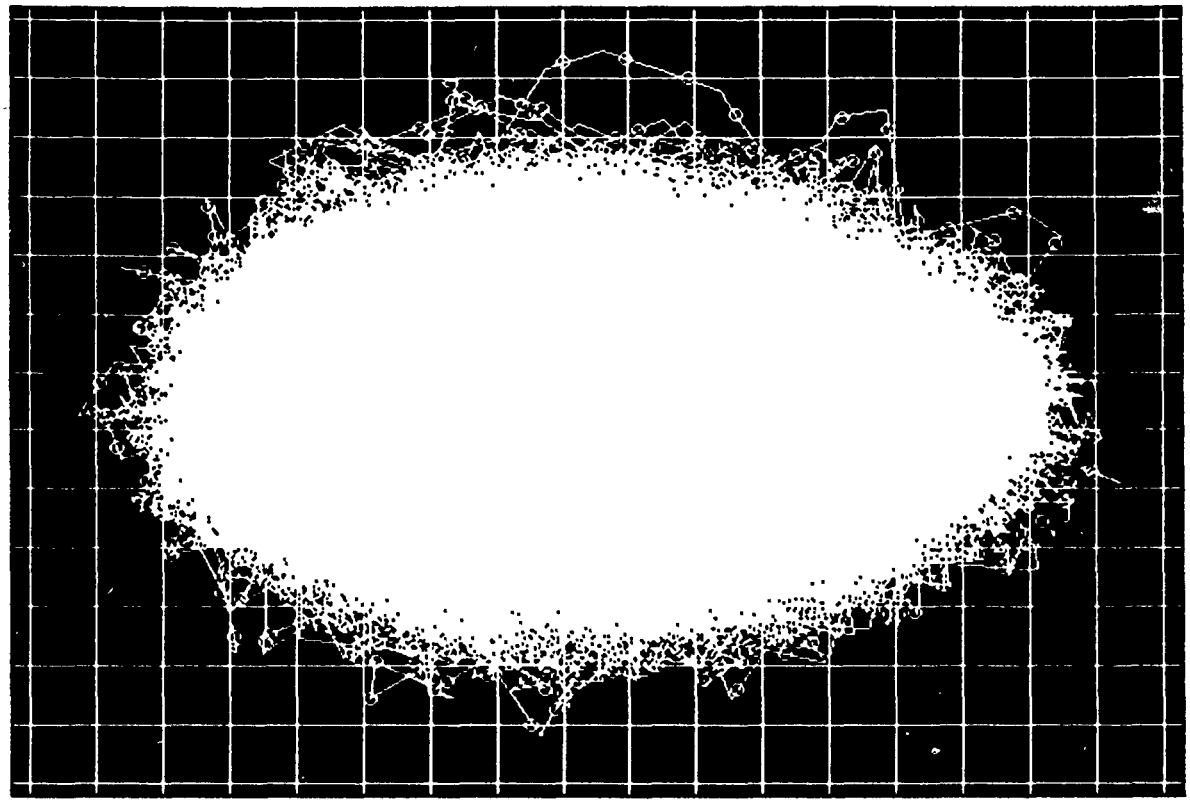

Figure 2. A superposition of 10,000 random tour tracks. These tracks determined the Markovian transition matrices that generated the diffusion probability maps that follow.

RANTRACK.BAS random tour probability map

number of time steps = 0

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	100000		0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 1

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	87	1161	961	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	316	1561	3733	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	80	1133	968	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 2

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	12	124	233	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	84	451	1205	814	0	0	0	0	0	0	0	0	0	0	0	0
0	0	4	136	627	1586	1739	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	106	456	1223	842	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	15	130	211	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
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leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 3

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	17	28	3	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	16	101	236	335	17	0	0	0	0	0	0	0	0	0	0	0
0	0	2	33	228	637	994	541	0	0	0	0	0	0	0	0	0	0	0
0	1	8	65	315	831	1437	903	0	0	0	0	0	0	0	0	0	0	0
0	0	5	51	246	619	1042	521	0	0	0	0	0	0	0	0	0	0	0
0	0	2	21	103	214	356	33	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	5	32	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 4

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	3	16	42	54	22	0	0	0	0	0	0	0	0	0	0	0
0	0	1	8	45	176	272	309	20	0	0	0	0	0	0	0	0	0	0
0	0	3	22	126	337	722	832	294	0	0	0	0	0	0	0	0	0	0
0	0	6	31	177	449	949	1175	485	0	0	0	0	0	0	0	0	0	0
0	0	5	29	126	377	746	859	271	0	0	0	0	0	0	0	0	0	0
0	0	0	17	61	137	307	315	29	0	0	0	0	0	0	0	0	0	0
0	0	0	1	15	29	61	32	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
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random number seed = 7351
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number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 5

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	3	5	8	5	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	5	36	67	62	25	0	0	0	0	0	0	0	0	0	0
0	0	0	10	36	102	240	288	254	19	0	0	0	0	0	0	0	0	0
0	0	4	10	58	220	467	732	625	169	0	0	0	0	0	0	0	0	0
0	0	1	25	94	270	594	968	882	230	0	0	0	0	0	0	0	0	0
0	0	5	20	72	204	467	735	653	156	0	0	0	0	0	0	0	0	0
0	0	3	11	38	103	196	317	237	23	0	0	0	0	0	0	0	0	0
0	0	0	2	13	23	57	89	35	0	0	0	0	0	0	0	0	0	0
0	0	0	0	2	5	6	13	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random-tour probability map

number of time steps = 16

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	12	3	18	8	1	0	0	0	0	0	0	0	0	0
0	0	0	0	5	17	56	84	67	28	0	0	0	0	0	0	0	0	0
0	0	0	3	22	79	148	284	298	181	24	0	0	0	0	0	0	0	0
0	0	0	11	35	108	303	542	668	462	84	0	0	0	0	0	0	0	0
0	0	0	8	54	149	406	672	866	595	123	0	0	0	0	0	0	0	0
0	0	0	18	34	119	305	571	668	451	85	0	0	0	0	0	0	0	0
0	0	0	5	38	69	151	243	327	182	10	0	0	0	0	0	0	0	0
0	0	0	0	8	23	46	76	70	34	0	0	0	0	0	0	0	0	0
0	0	0	0	1	3	12	16	10	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 7

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	6	7	10	15	3	2	0	0	0	0	0	0	0	0
0	0	0	0	0	21	47	68	99	69	19	0	0	0	0	0	0	0	0
0	0	0	0	4	39	107	212	306	249	128	12	0	0	0	0	0	0	0
0	0	0	0	30	68	189	393	575	598	311	46	0	0	0	0	0	0	0
0	0	0	0	27	87	220	464	733	730	393	76	0	0	0	0	0	0	0
0	0	0	0	36	87	187	421	557	542	327	43	0	0	0	0	0	0	0
0	0	0	0	12	58	96	193	300	281	115	10	0	0	0	0	0	0	0
0	0	0	0	0	19	43	67	85	68	20	0	0	0	0	0	0	0	0
0	0	0	0	0	4	12	17	15	11	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 8

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	8	10	19	12	6	0	0	0	0	0	0	0	0
0	0	0	0	0	0	35	59	85	89	61	17	0	0	0	0	0	0	0
0	0	0	0	0	7	100	127	247	296	200	85	10	0	0	0	0	0	0
0	0	0	0	0	66	114	289	442	565	477	208	17	0	0	0	0	0	0
0	0	0	0	0	66	141	290	532	706	634	270	42	0	0	0	0	0	0
0	0	0	0	0	86	122	272	447	573	457	197	22	0	0	0	0	0	0
0	0	0	0	0	8	93	135	242	305	229	62	2	0	0	0	0	0	0
0	0	0	0	0	0	44	53	82	80	67	10	0	0	0	0	0	0	0
0	0	0	0	0	0	8	20	13	17	10	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	3	1	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 9

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	9	21	31	10	6	2	0	0	0	0	0	0
0	0	0	0	0	0	0	55	69	69	78	34	8	0	0	0	0	0	0
0	0	0	0	0	0	11	163	184	259	259	162	45	4	0	0	0	0	0
0	0	0	0	0	0	124	185	348	479	543	371	144	8	0	0	0	0	0
0	0	0	0	0	0	142	191	394	593	656	481	175	15	0	0	0	0	0
0	0	0	0	0	0	147	143	353	477	556	362	143	13	0	0	0	0	0
0	0	0	0	0	0	5	170	182	277	249	141	33	1	0	0	0	0	0
0	0	0	0	0	0	0	72	65	80	81	41	4	0	0	0	0	0	0
0	0	0	0	0	0	0	13	15	15	17	7	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 10

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	2	28	17	6	3	2	0	0	0	0	0
0	0	0	0	0	0	0	0	71	71	79	58	19	5	0	0	0	0	0
0	0	0	0	0	0	0	0	268	203	244	218	107	23	1	0	0	0	0
0	0	0	0	0	0	0	235	228	426	473	459	284	74	2	0	0	0	0
0	0	0	0	0	0	0	238	278	471	633	619	370	120	7	0	0	0	0
0	0	0	0	0	0	0	222	256	416	511	504	255	82	4	0	0	0	0
0	0	0	0	0	0	0	0	253	188	262	200	94	22	0	0	0	0	0
0	0	0	0	0	0	0	0	88	68	78	69	17	3	0	0	0	0	0
0	0	0	0	0	0	0	0	5	24	13	10	5	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	2	1	4	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 11

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	20	16	6	2	0	0	0	0	0
0	0	0	0	0	0	0	0	0	74	69	73	41	11	3	0	0	0	0
0	0	0	0	0	0	0	0	0	346	217	196	162	64	13	0	0	0	0
0	0	0	0	0	0	0	0	316	352	450	472	427	176	46	1	0	0	0
0	0	0	0	0	0	0	0	399	361	596	646	555	297	76	3	0	0	0
0	0	0	0	0	0	0	0	331	338	424	458	403	160	43	2	0	0	0
0	0	0	0	0	0	0	0	0	327	205	257	158	55	8	0	0	0	0
0	0	0	0	0	0	0	0	0	106	75	65	47	12	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	19	12	5	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 12

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	9	15	4	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	57	66	53	13	2	1	0	0	0
0	0	0	0	0	0	0	0	0	0	390	223	181	99	33	6	0	0	0
0	0	0	0	0	0	0	0	0	419	498	472	467	325	122	16	0	0	0
0	0	0	0	0	0	0	0	0	653	471	588	652	479	255	40	1	0	0
0	0	0	0	0	0	0	0	0	420	466	455	469	287	99	14	0	0	0
0	0	0	0	0	0	0	0	0	0	408	200	188	92	19	2	0	0	0
0	0	0	0	0	0	0	0	0	0	85	85	42	30	3	2	0	0	0
0	0	0	0	0	0	0	0	0	0	0	11	10	2	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 13

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	16	52	36	4	1	1	0	0
0	0	0	0	0	0	0	0	0	0	0	409	197	113	47	9	0	0	0
0	0	0	0	0	0	0	0	0	0	530	676	465	471	207	60	4	0	0
0	0	0	0	0	0	0	0	0	0	1046	546	629	696	452	91	4	0	0
0	0	0	0	0	0	0	0	0	0	504	637	471	422	199	48	6	0	0
0	0	0	0	0	0	0	0	0	0	0	450	164	147	50	8	2	0	0
0	0	0	0	0	0	0	0	0	0	0	18	69	25	10	2	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 14

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	15	10	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	267	176	55	19	2	0	0
0	0	0	0	0	0	0	0	0	0	0	575	899	537	379	80	16	0	0
0	0	0	0	0	0	0	0	0	0	0	1676	661	736	732	174	20	0	0
0	0	0	0	0	0	0	0	0	0	0	563	891	482	357	82	14	0	0
0	0	0	0	0	0	0	0	0	0	0	0	300	145	84	20	3	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 15

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	45	113	9	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	449	1190	469	209	7	0	0
0	0	0	0	0	0	0	0	0	0	0	0	2891	867	976	271	37	0	0
0	0	0	0	0	0	0	0	0	0	0	0	463	1170	472	189	13	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	36	108	16	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 16

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1029	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	5586	1715	678	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	992	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS random tour probability map

number of time steps = 17

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	10000	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

Table I. A dynamic diffusion transition matrix that was used to generate the dynamic diffusion map for 1 transition.

RANTRACK.BAS dynamic transition matrix

transition number = 1

x = -5
y = 0

87	1161	961
316	1561	3733
80	1133	968

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0

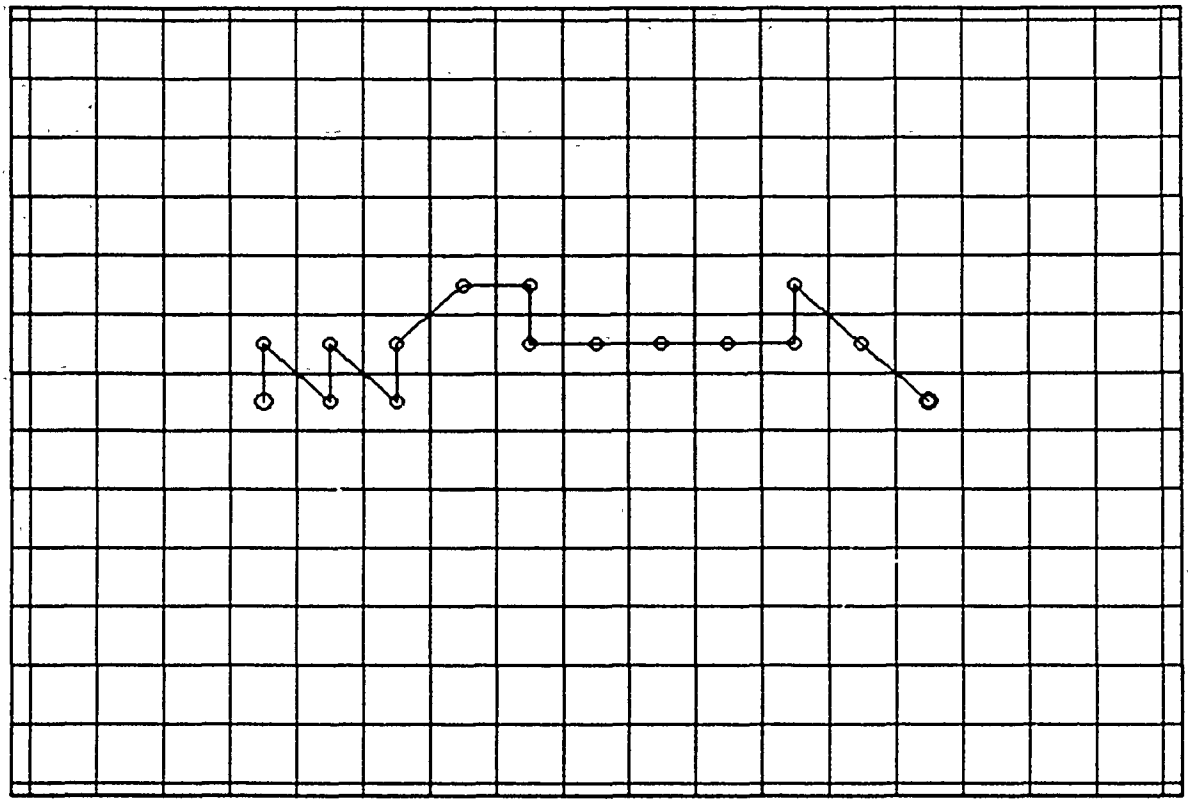

Figure 3 A track generated by a dynamic process. The dynamic transition matrices were determined by the random tour tracks shown in Figure 2. The number of diffusions is 17. The circles are defined in Figure 1.

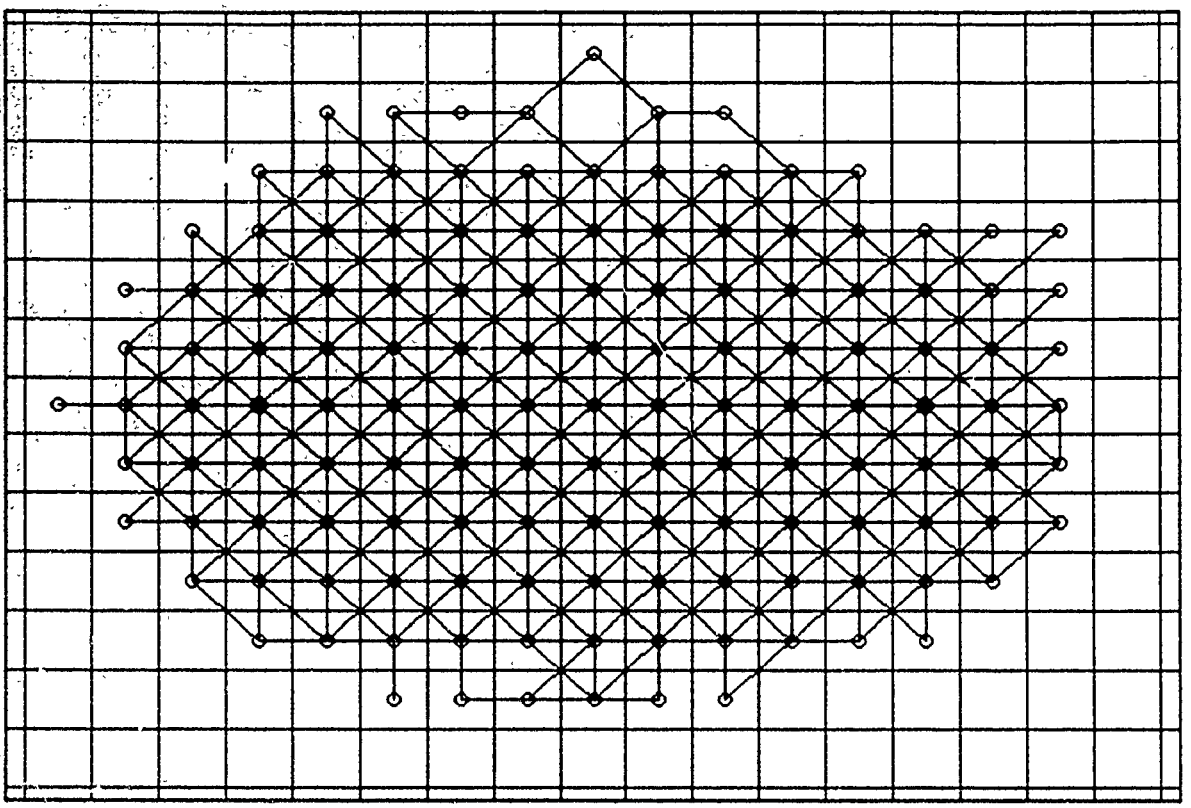

Figure 4 A superposition of 10,000 dynamic diffusion tracks. Their dynamic transition matrices were determined by the random tour tracks shown in Figure 2. The number of diffusions is 17. The circles are defined in Figure 1.

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 0

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	10000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 1

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	87	1161	961	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	316	1561	3733	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	80	1133	968	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 2

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	12	124	233	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	84	451	1205	814	0	0	0	0	0	0	0	0	0	0	0	0
0	0	4	136	627	1586	1739	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	106	456	1223	842	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	15	130	211	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 3

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	17	28	3	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	16	101	236	335	17	0	0	0	0	0	0	0	0	0	0	0
0	0	2	33	228	637	994	541	0	0	0	0	0	0	0	0	0	0	0
0	1	8	65	315	831	1437	903	0	0	0	0	0	0	0	0	0	0	0
0	0	5	51	246	619	1042	521	0	0	0	0	0	0	0	0	0	0	0
0	0	2	21	103	214	356	33	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	5	32	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 4

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	3	16	42	54	22	0	0	0	0	0	0	0	0	0	0	0
0	0	1	8	45	176	272	309	20	0	0	0	0	0	0	0	0	0	0
0	0	3	22	126	337	722	832	294	0	0	0	0	0	0	0	0	0	0
0	0	6	31	177	449	949	1175	485	0	0	0	0	0	0	0	0	0	0
0	0	5	29	126	377	746	859	271	0	0	0	0	0	0	0	0	0	0
0	0	0	17	61	137	307	315	29	0	0	0	0	0	0	0	0	0	0
0	0	0	1	15	29	61	32	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 5

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	3	5	8	5	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	5	36	67	62	25	0	0	0	0	0	0	0	0	0	0
0	0	0	10	36	102	240	288	254	19	0	0	0	0	0	0	0	0	0
0	0	4	10	58	220	467	732	625	169	0	0	0	0	0	0	0	0	0
0	0	1	25	94	270	594	968	882	230	0	0	0	0	0	0	0	0	0
0	0	5	20	72	204	467	735	653	156	0	0	0	0	0	0	0	0	0
0	0	3	11	38	103	196	317	237	23	0	0	0	0	0	0	0	0	0
0	0	0	2	13	23	57	89	35	0	0	0	0	0	0	0	0	0	0
0	0	0	0	2	5	6	13	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 6

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	12	3	18	8	1	0	0	0	0	0	0	0	0	0
0	0	0	0	5	17	56	84	67	28	0	0	0	0	0	0	0	0	0
0	0	0	3	22	79	148	284	298	181	24	0	0	0	0	0	0	0	0
0	0	0	11	35	108	303	542	668	462	84	0	0	0	0	0	0	0	0
0	0	0	8	54	149	406	672	866	595	123	0	0	0	0	0	0	0	0
0	0	0	18	34	119	305	571	668	451	85	0	0	0	0	0	0	0	0
0	0	0	5	38	69	151	243	327	182	10	0	0	0	0	0	0	0	0
0	0	0	0	8	23	46	76	70	34	0	0	0	0	0	0	0	0	0
0	0	0	0	1	3	12	16	10	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 7

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	6	7	10	15	3	2	0	0	0	0	0	0	0	0
0	0	0	0	0	21	47	68	99	69	19	0	0	0	0	0	0	0	0
0	0	0	0	4	39	107	212	306	249	128	12	0	0	0	0	0	0	0
0	0	0	0	30	68	189	393	575	598	311	46	0	0	0	0	0	0	0
0	0	0	0	27	87	220	464	733	730	393	76	0	0	0	0	0	0	0
0	0	0	0	36	87	187	421	557	542	327	43	0	0	0	0	0	0	0
0	0	0	0	12	58	96	193	300	281	115	10	0	0	0	0	0	0	0
0	0	0	0	0	19	43	67	85	68	20	0	0	0	0	0	0	0	0
0	0	0	0	0	4	12	17	15	11	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 8

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	8	10	19	12	6	0	0	0	0	0	0	0	0
0	0	0	0	0	0	35	59	85	89	61	17	0	0	0	0	0	0	0
0	0	0	0	0	7	100	127	247	296	200	85	10	0	0	0	0	0	0
0	0	0	0	0	66	114	289	442	565	477	208	17	0	0	0	0	0	0
0	0	0	0	0	66	141	290	532	706	634	270	42	0	0	0	0	0	0
0	0	0	0	0	86	122	272	447	573	457	197	22	0	0	0	0	0	0
0	0	0	0	0	8	93	135	242	305	229	62	2	0	0	0	0	0	0
0	0	0	0	0	0	44	53	82	80	67	10	0	0	0	0	0	0	0
0	0	0	0	0	0	8	20	13	17	10	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	3	1	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 9

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	9	21	31	10	6	2	0	0	0	0	0	0
0	0	0	0	0	0	0	55	69	69	78	34	8	0	0	0	0	0	0
0	0	0	0	0	0	11	163	184	259	259	162	45	4	0	0	0	0	0
0	0	0	0	0	0	124	185	348	479	543	371	144	8	0	0	0	0	0
0	0	0	0	0	0	142	191	394	593	656	481	175	15	0	0	0	0	0
0	0	0	0	0	0	147	143	353	477	556	362	143	13	0	0	0	0	0
0	0	0	0	0	0	5	170	182	277	249	141	33	1	0	0	0	0	0
0	0	0	0	0	0	0	72	65	80	81	41	4	0	0	0	0	0	0
0	0	0	0	0	0	0	13	15	15	17	7	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 10

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	2	28	17	6	3	2	0	0	0	0	0
0	0	0	0	0	0	0	0	71	71	79	58	19	5	0	0	0	0	0
0	0	0	0	0	0	0	0	268	203	244	218	107	23	1	0	0	0	0
0	0	0	0	0	0	0	235	228	426	473	459	284	74	2	0	0	0	0
0	0	0	0	0	0	0	238	278	471	633	619	370	120	7	0	0	0	0
0	0	0	0	0	0	0	222	256	416	511	504	255	82	4	0	0	0	0
0	0	0	0	0	0	0	0	253	188	262	200	94	22	0	0	0	0	0
0	0	0	0	0	0	0	0	88	68	78	69	17	3	0	0	0	0	0
0	0	0	0	0	0	0	0	5	24	13	10	5	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	2	1	4	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 11

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	20	16	6	2	0	0	0	0	0
0	0	0	0	0	0	0	0	0	74	69	73	41	11	3	0	0	0	0
0	0	0	0	0	0	0	0	0	346	217	196	162	64	13	0	0	0	0
0	0	0	0	0	0	0	0	316	352	450	472	427	176	46	1	0	0	0
0	0	0	0	0	0	0	0	399	361	596	646	555	297	76	3	0	0	0
0	0	0	0	0	0	0	0	331	338	424	458	403	160	43	2	0	0	0
0	0	0	0	0	0	0	0	0	327	205	257	158	55	8	0	0	0	0
0	0	0	0	0	0	0	0	0	106	75	65	47	12	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	19	12	5	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 12

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	9	15	4	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	57	66	53	13	2	1	0	0	0
0	0	0	0	0	0	0	0	0	0	390	223	181	99	33	6	0	0	0
0	0	0	0	0	0	0	0	0	419	498	472	467	325	122	16	0	0	0
0	0	0	0	0	0	0	0	0	653	471	588	652	479	255	40	1	0	0
0	0	0	0	0	0	0	0	0	420	466	455	469	287	99	14	0	0	0
0	0	0	0	0	0	0	0	0	0	408	200	188	92	19	2	0	0	0
0	0	0	0	0	0	0	0	0	0	85	85	42	30	3	2	0	0	0
0	0	0	0	0	0	0	0	0	0	0	11	10	2	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time-step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 13

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	16	52	36	4	1	1	0	0
0	0	0	0	0	0	0	0	0	0	0	409	197	113	47	9	0	0	0
0	0	0	0	0	0	0	0	0	0	530	676	465	471	207	60	4	0	0
0	0	0	0	0	0	0	0	0	0	1046	546	629	696	452	91	4	0	0
0	0	0	0	0	0	0	0	0	0	504	637	471	422	199	48	6	0	0
0	0	0	0	0	0	0	0	0	0	0	450	164	147	50	8	2	0	0
0	0	0	0	0	0	0	0	0	0	0	18	69	25	10	2	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 14

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	15	10	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	267	176	55	19	2	0	0
0	0	0	0	0	0	0	0	0	0	0	575	899	537	379	80	16	0	0
0	0	0	0	0	0	0	0	0	0	0	1676	661	736	732	174	20	0	0
0	0	0	0	0	0	0	0	0	0	0	563	891	482	357	82	14	0	0
0	0	0	0	0	0	0	0	0	0	0	0	300	145	84	20	3	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 15

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	45	113	9	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	449	1190	469	209	7	0	0
0	0	0	0	0	0	0	0	0	0	0	0	2891	867	976	271	37	0	0
0	0	0	0	0	0	0	0	0	0	0	0	463	1170	472	189	13	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	36	108	16	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 16

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1029	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	5586	1715	678	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	992	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

RANTRACK.BAS dynamic diffusion probability map

number of diffusions = 17

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	100000		0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000

Table II. A static diffusion transition matrix that was used to generate the static diffusion maps.

RANTRACK.BAS static transition matrix

x = -5
y = 0

107	1407	1290
375	2008	4848
99	1389	1332

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0

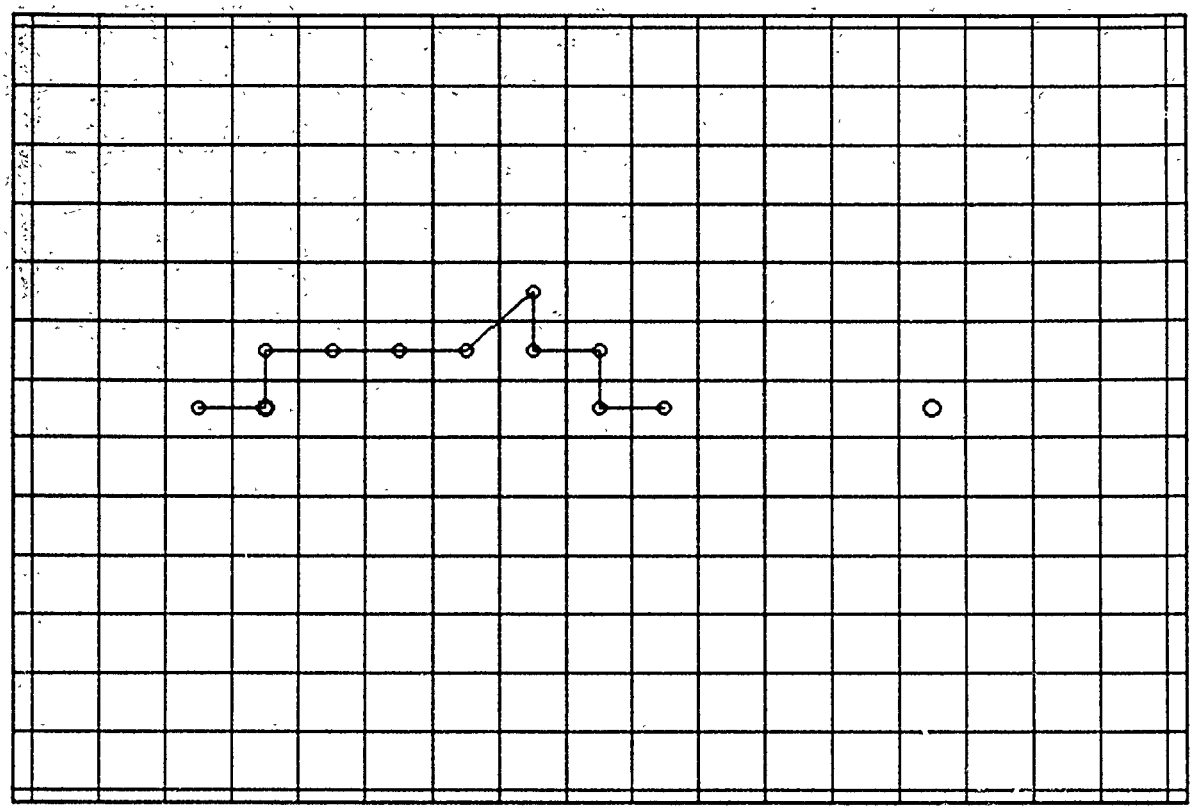

Figure 5 A track generated by a static diffusion process. The static transition matrices were determined by the random tour tracks shown in Figure 2. The number of diffusions is 17. The circles are defined in Figure 1.

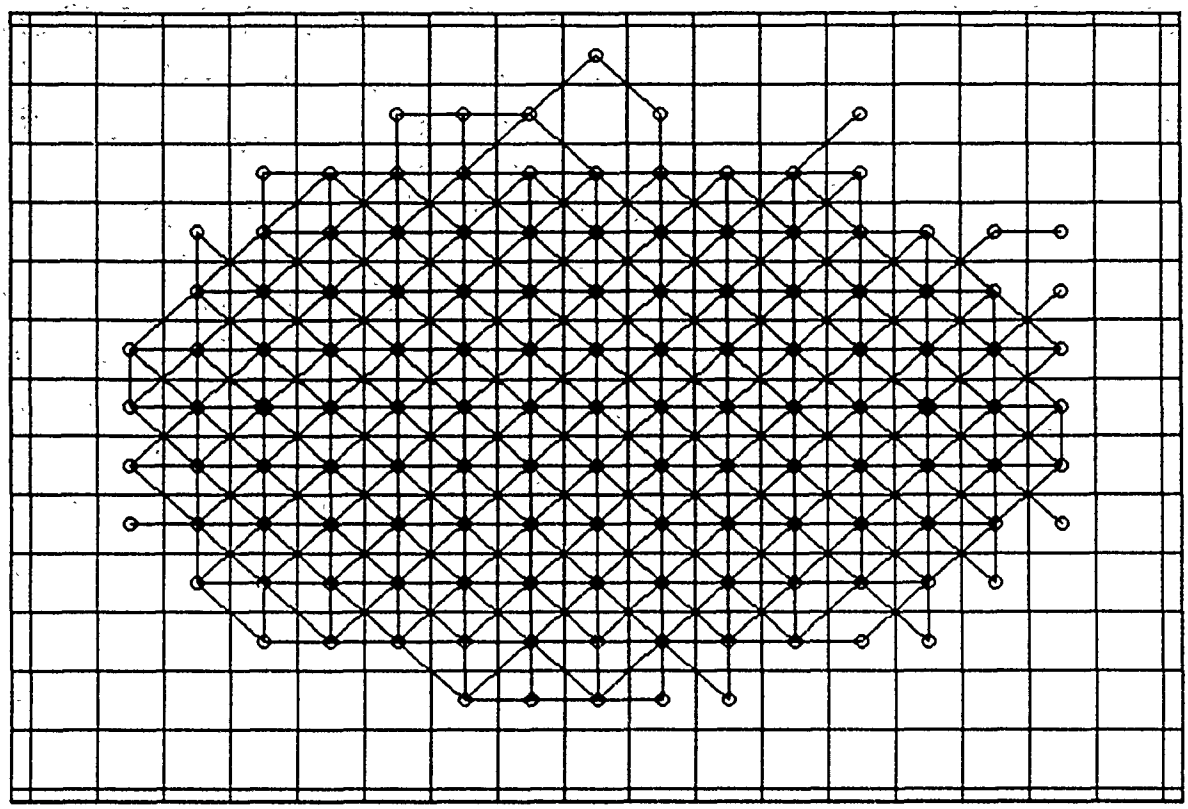

Figure 6 A superposition of 10,000 static diffusion tracks. Their static transition matrices were determined by the random tour tracks shown in Figure 2. The number of diffusions is 17. The circles are defined in Figure 1.

RANTRACK.BAS static diffusion probability map

number of diffusions = 0

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0		100000	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 1

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	83	1095	1004	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	292	1562	3771	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	77	1081	1036	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 2

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	11	114	209	82	0	0	0	0	0	0	0	0	0	0	0	0
0	0	3	71	462	1053	851	0	0	0	0	0	0	0	0	0	0	0	0
0	0	6	133	644	1560	1862	0	0	0	0	0	0	0	0	0	0	0	0
0	0	4	88	457	1067	915	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	16	121	183	88	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 3

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	11	27	21	6	0	0	0	0	0	0	0	0	0	0	0
0	0	0	12	80	223	243	102	0	0	0	0	0	0	0	0	0	0	0
0	0	3	40	238	638	940	595	0	0	0	0	0	0	0	0	0	0	0
0	0	5	70	299	811	1364	1016	0	0	0	0	0	0	0	0	0	0	0
0	0	4	55	243	643	963	622	0	0	0	0	0	0	0	0	0	0	0
0	0	1	17	92	202	244	109	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	8	22	19	7	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 4

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	3	2	2	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	10	34	46	33	9	0	0	0	0	0	0	0	0	0	0
0	0	0	9	53	161	260	237	98	0	0	0	0	0	0	0	0	0	0
0	0	2	23	127	374	694	797	382	0	0	0	0	0	0	0	0	0	0
0	0	3	38	154	439	907	1089	605	0	0	0	0	0	0	0	0	0	0
0	0	3	34	135	380	704	800	391	0	0	0	0	0	0	0	0	0	0
0	0	1	13	63	148	256	241	103	0	0	0	0	0	0	0	0	0	0
0	0	0	1	9	28	44	34	10	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	2	3	2	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 5

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	5	4	5	3	1	0	0	0	0	0	0	0	0	0
0	0	0	1	8	28	51	57	36	9	0	0	0	0	0	0	0	0	0
0	0	0	6	33	106	208	269	221	75	0	0	0	0	0	0	0	0	0
0	0	1	13	71	218	463	707	612	252	0	0	0	0	0	0	0	0	0
0	0	2	21	84	246	574	890	850	376	0	0	0	0	0	0	0	0	0
0	0	2	20	77	224	471	699	617	253	0	0	0	0	0	0	0	0	0
0	0	1	9	41	99	203	268	223	80	0	0	0	0	0	0	0	0	0
0	0	0	1	8	24	50	61	36	10	0	0	0	0	0	0	0	0	0
0	0	0	0	1	3	6	7	2	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 6

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	5	5	8	7	4	1	0	0	0	0	0	0	0	0
0	0	0	0	5	20	44	62	59	30	7	0	0	0	0	0	0	0	0
0	0	0	4	20	67	148	234	272	179	54	0	0	0	0	0	0	0	0
0	0	1	7	40	128	296	540	630	480	166	0	0	0	0	0	0	0	0
0	0	1	12	47	141	356	647	824	647	258	0	0	0	0	0	0	0	0
0	0	1	12	45	133	303	530	633	473	167	0	0	0	0	0	0	0	0
0	0	1	5	25	64	144	232	269	184	54	0	0	0	0	0	0	0	0
0	0	0	0	6	18	43	68	60	33	8	0	0	0	0	0	0	0	0
0	0	0	0	1	3	7	11	5	3	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg-length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 7

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	4	5	9	10	8	3	0	0	0	0	0	0	0	0
0	0	0	0	3	13	33	55	68	50	23	4	0	0	0	0	0	0	0
0	0	0	3	12	41	99	180	258	239	136	34	0	0	0	0	0	0	0
0	0	0	4	23	76	185	382	538	568	366	109	0	0	0	0	0	0	0
0	0	1	7	27	82	219	444	680	725	528	196	0	0	0	0	0	0	0
0	0	1	7	26	80	191	375	541	553	363	108	0	0	0	0	0	0	0
0	0	0	3	16	40	97	178	253	243	136	34	0	0	0	0	0	0	0
0	0	0	0	4	12	32	61	69	54	25	4	0	0	0	0	0	0	0
0	0	0	0	0	2	6	13	8	6	2	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 8

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	3	4	8	11	11	5	2	0	0	0	0	0	0	0
0	0	0	0	2	8	23	43	63	60	40	15	2	0	0	0	0	0	0
0	0	0	2	8	25	64	128	213	245	197	95	18	0	0	0	0	0	0
0	0	0	2	13	45	115	259	416	540	486	273	68	0	0	0	0	0	0
0	0	0	4	16	48	134	294	512	668	673	454	173	0	0	0	0	0	0
0	0	0	4	16	48	119	254	419	523	479	269	68	0	0	0	0	0	0
0	0	0	2	10	25	64	127	209	248	197	94	16	0	0	0	0	0	0
0	0	0	0	2	8	23	48	64	65	43	14	2	0	0	0	0	0	0
0	0	0	0	0	2	5	12	9	9	5	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 9999.999
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 9

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	2	3	6	9	11	7	3	1	0	0	0	0	0	0
0	0	0	0	1	5	16	31	52	59	51	26	7	1	0	0	0	0	0
0	0	0	1	5	15	41	88	162	217	218	150	54	6	0	0	0	0	0
0	0	0	1	8	27	71	170	302	455	508	404	194	42	0	0	0	0	0
0	0	0	2	9	29	82	191	366	549	685	637	442	155	0	0	0	0	0
0	0	0	3	9	29	74	168	305	439	500	397	192	41	0	0	0	0	0
0	0	0	1	6	15	41	87	160	219	218	148	50	6	0	0	0	0	0
0	0	0	0	1	5	15	36	53	64	55	26	8	1	0	0	0	0	0
0	0	0	0	0	1	4	10	8	10	7	3	1	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 10

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	2	5	8	10	8	5	2	0	0	0	0	0	0
0	0	0	0	1	3	10	22	40	51	52	34	14	[illegible]	0	0	0	0	0
0	0	0	1	3	9	26	58	117	174	205	179	93	21	2	0	0	0	0
0	0	0	1	5	16	44	110	210	354	461	461	319	131	19	0	0	0	0
0	0	0	1	5	17	50	122	252	420	612	701	673	448	136	0	0	0	0
0	0	0	2	6	17	46	109	213	341	453	452	315	125	18	0	0	0	0
0	0	0	1	3	9	26	58	116	176	206	178	87	20	2	0	0	0	0
0	0	0	0	1	3	10	25	41	56	57	35	14	3	0	0	0	0	0
0	0	0	0	0	1	3	8	7	9	8	5	1	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 9999.999
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 11

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	1	3	6	9	8	5	3	1	0	0	0	0	0
0	0	0	0	0	2	7	15	29	41	47	37	20	5	1	0	0	0	0
0	0	0	0	2	6	16	38	81	132	175	180	119	39	7	0	0	0	0
0	0	0	0	3	10	27	70	142	261	381	451	398	232	73	4	0	0	0
0	0	0	1	3	10	31	78	169	306	501	668	794	768	503	19	0	0	0
0	0	0	1	3	10	28	70	145	251	376	441	393	220	69	4	0	0	0
0	0	0	0	2	6	16	38	81	134	176	181	112	37	8	0	0	0	0
0	0	0	0	1	2	6	17	30	45	52	39	20	5	1	0	0	0	0
0	0	0	0	0	0	2	5	5	8	8	5	2	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 9999.999
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 12

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	1	2	4	7	6	5	3	1	0	0	0	0	0
0	0	0	0	0	1	4	10	20	31	39	34	22	8	1	0	0	0	0
0	0	0	0	1	3	10	24	55	95	138	163	128	55	15	1	0	0	0
0	0	0	0	2	6	16	45	94	185	296	397	419	312	160	16	0	0	0
0	0	0	0	2	6	19	49	112	216	386	577	801	1013	1091	76	1	0	0
0	0	0	1	2	6	17	44	97	178	293	388	413	295	154	16	0	0	0
0	0	0	0	1	3	10	25	55	97	140	164	122	52	15	1	0	0	0
0	0	0	0	0	1	4	12	21	34	44	37	23	8	2	0	0	0	0
0	0	0	0	0	0	1	4	4	6	7	5	3	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 13

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	3	5	5	4	3	1	0	0	0	0	0
0	0	0	0	0	1	3	6	14	22	31	30	22	9	2	0	0	0	0
0	0	0	0	1	2	6	15	36	66	104	136	122	64	23	2	0	0	0
0	0	0	0	1	3	10	28	62	128	219	325	393	354	265	38	1	0	0
0	0	0	0	1	4	11	31	73	148	285	466	728	1144	1818	178	3	0	0
0	0	0	0	1	4	11	28	63	123	217	318	388	334	258	36	1	0	0
0	0	0	0	1	2	6	16	36	68	106	138	118	60	24	2	0	0	0
0	0	0	0	0	1	3	8	14	25	35	33	23	10	2	0	0	0	0
0	0	0	0	0	0	1	3	3	5	6	5	3	1	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 9999.999
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 14

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	2	3	4	4	3	1	0	0	0	0	0
0	0	0	0	0	0	2	4	9	16	23	24	20	10	2	0	0	0	0
0	0	0	0	0	1	4	10	24	45	75	106	107	65	29	4	0	0	0
0	0	0	0	1	2	6	18	40	86	157	252	340	359	372	68	2	0	0
0	0	0	0	1	2	7	19	47	99	203	357	614	1169	2581	314	7	0	0
0	0	0	0	1	2	6	17	41	83	156	247	336	338	366	63	3	0	0
0	0	0	0	0	1	4	10	24	47	77	109	105	62	30	4	0	0	0
0	0	0	0	0	0	2	5	9	17	26	27	21	10	3	0	0	0	0
0	0	0	0	0	0	0	2	2	3	5	4	3	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 15

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	2	3	3	3	1	0	0	0	0	0
0	0	0	0	0	0	1	3	6	11	16	18	17	10	2	0	0	0	0
0	0	0	0	0	1	2	6	15	30	53	80	88	61	34	5	0	0	0
0	0	0	0	0	1	4	11	25	57	109	187	277	338	467	101	4	0	0
0	0	0	0	0	1	4	12	30	66	141	263	490	1120	3299	468	12	0	0
0	0	0	0	0	1	4	11	26	55	109	184	274	318	465	93	6	0	0
0	0	0	0	0	1	2	6	15	31	55	83	87	58	34	6	1	0	0
0	0	0	0	0	0	1	3	6	12	19	21	18	10	3	0	0	0	0
0	0	0	0	0	0	0	1	1	2	3	3	2	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 9999.999
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 16

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	2	2	2	2	1	0	0	0	0	0
0	0	0	0	0	0	1	2	4	7	11	13	14	8	2	0	0	0	0
0	0	0	0	0	0	1	4	10	20	36	58	69	53	36	7	0	0	0
0	0	0	0	0	1	2	7	16	37	74	135	215	303	546	133	7	0	0
0	0	0	0	0	1	3	7	19	43	96	188	374	1031	3923	622	19	0	0
0	0	0	0	0	1	2	7	17	36	74	133	213	285	548	123	9	0	0
0	0	0	0	0	0	1	4	10	21	38	60	68	51	36	8	1	0	0
0	0	0	0	0	0	1	2	4	8	14	16	14	9	3	1	0	0	0
0	0	0	0	0	0	0	1	1	2	2	3	2	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = .3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

RANTRACK.BAS static diffusion probability map

number of diffusions = 17

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1	1	1	2	1	0	0	0	0	0
0	0	0	0	0	0	0	1	2	5	8	9	10	7	2	0	0	0	0
0	0	0	0	0	0	1	2	6	13	24	41	52	44	36	8	1	0	0
0	0	0	0	0	0	1	4	10	24	50	95	162	263	606	163	9	0	0
0	0	0	0	0	0	2	5	12	28	64	131	277	930	4434	764	26	0	0
0	0	0	0	0	0	1	4	11	23	50	93	160	248	613	150	12	0	0
0	0	0	0	0	0	1	2	6	13	25	43	52	42	36	10	1	0	0
0	0	0	0	0	0	0	1	3	5	9	11	11	7	3	1	0	0	0
0	0	0	0	0	0	0	0	1	1	2	2	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

submarine speed in knots = 10
distance between end points in nautical miles = 30
length of a cell side in nautical miles = 3
time step in hours = .3
maximum number of time steps = 17
track length in nautical miles = 50
delta in nautical miles = 5
leg length distribution index = 3
random number generator = standard
random number seed = 7351
number of tracks completed = 10000
number of tracks terminated = 0
cell entry sum = 10000
cell entries are rounded integer

VI. The Analysis Program

The analysis program requires the following inputs: the speed of the submarine in knots; the distance between the end points in nautical miles; the track length in nautical miles; delta, the average distance between course changes (leg length) in nautical miles; the leg length distribution parameter, an integer that defines the gamma distribution that determines leg length (Inputing 1 gives an exponential distribution.) and the number of tracks to be generated. If an auxiliary pseudorandom number generator is not chosen, the option to supply a seed for the QuickBASIC random number generator is given. Next, the option to either view single tracks and terminate the program or to input the number of tracks to be generated to produce data of the kind presented above.

The program is written for a computer monitor with screen mode 12 capability. To change this requirement, the statement SCREEN 12 on Line 4780 must be changed. For example, for a monitor with CGA capability, it could be replaced by SCREEN 2.

To run the program under QuickBASIC, the /ah switch must be used to duplicate the program results in this report. This switch allows arrays of size greater than 64K. In addition, it may be necessary to have FILES = 8 and BUFFERS = 2 in the CONFIG.SYS file and to remove TSR file activation statements from the AUTOEXEC.BAT file.

The program code listed in Appendix 1 provides for the addition of an auxiliary random number generator as an alternative to the QuickBASIC generator through Lines 200, 210 and 220. These

lines allow auxiliary generator setup code in a subroutine starting at Line 7720 and generator code in a subroutine starting at Line 7810. This line number was chosen to accommodate code that is based on a Generalized Feedback Shift Register (GFSR) pseudorandom number generator that is listed in Reference 3. If an auxiliary generator will not be added, Lines 200, 210 and 220 can be removed.

Appendix 1. The Analysis Program Listing

```
10 N$ = "RANTRACK.BAS": REM a program to analyze some random track generation procedures
20 CLS : DEFINT I-N
30 PI = 4 * ATN(1): NTR = 0: R$ = "standard": FLAG3 = 0: FLAG4 = 0: FLAG5 = 0
40 PRINT : INPUT "submarine speed in knots"; V
50 PRINT : INPUT "distance between the end points in nautical miles"; D
60 PRINT : INPUT "track length in nautical miles"; TL
70 IF TL < D THEN 60
80 DM = SQR(TL * TL - D * D) / 2: REM maximum distance from the x-axis
90 SL = DM / 7: IF D / 2 > SL THEN SL = (D / 2) / INT(D / 2 / SL): REM length of a cell side
100 TS = SL / V: REM time step in hours
110 MNS = 30: REM maximum number of steps
120 NS = CINT(TL / SL): REM number of time steps in the track
130 IF NS > MNS THEN GOTO 60
140 SF = (64 / 35) * DM / 1000: REM screen factor
150 A$ = "cell dimension = " + STR$(SL) + " nm": B$ = "time step =" + STR$(TS) + " hr"
160 PRINT : PRINT A$: PRINT : PRINT B$
170 PRINT : INPUT "delta in nautical miles"; DEL: REM maximum average leg length in nautical miles
180 IF DEL < TL * TL / (TL - D) / 50 THEN 170
190 PRINT : INPUT "leg length distribution index"; NI
200 A$ = " ": PRINT : INPUT "standard or auxiliary random number generator (s/a)"; A$
210 IF A$ = "A" OR A$ = "a" THEN GOSUB 7720: GOTO 280
220 IF A$ = "S" OR A$ = "s" THEN 230 ELSE 200
230 A$ = " ": PRINT : INPUT "supply a random number seed (y/n)"; A$
240 IF A$ = "N" OR A$ = "n" THEN 280
250 IF A$ = "Y" OR A$ = "y" THEN FLAG4 = 1 ELSE 230
260 PRINT : INPUT "random number seed"; RNS
270 IF RNS < -32768! OR RNS > 32767 THEN 260 ELSE RANDOMIZE RNS
280 A$ = " ": PRINT : INPUT "view only single tracks (y/n)"; A$
290 IF A$ = "Y" OR A$ = "y" THEN FLAG5 = 1: NT = 1: GOTO 320
300 IF A$ = "N" OR A$ = "n" THEN 310 ELSE 280
310 PRINT : INPUT "number of tracks"; NT
320 A0 = TL / 2: REM semimajor axis of the initial focusing ellipse
330 C0 = D / 2: REM distance from the center to a focus of the initial focusing ellipse
340 MNL = 30
350 LL = 9: LU = 9: ML = 10: MU = 10: MT = 6
360 REDIM MP(-LL TO LU, -ML TO MU, MNS)
370 REDIM MT(-1 TO 1, -1 TO 1, -LL TO LU, -ML TO MU, MNS)
380 REDIM MTS(-1 TO 1, -1 TO 1, -LL TO LU, -ML TO MU)
390 FOR J = 1 TO NT
400 REDIM X(MNL + 1), Y(MNL + 1), XS(MNL + 1), YS(MNL + 1), FR(MNL + 1), T(MNL + 1), TLEG(MNL + 1)
410 X(0) = -D / 2: Y(0) = 0: REM coordinates of the initial point for all tracks
420 FR(0) = 0: TLEG(0) = 0
430 FLAG1 = 0
440 A = A0: C = C0: S = 0
450 GOSUB 4770
460 FOR I = 1 TO MNL: REM leg number
470 B1 = SQR((TL + D) / (TL - D))
480 B2 = SQR(1 - D * D / TL / TL)
490 GOSUB 7700
500 ON ERROR GOTO 510: GOTO 520
510 RESUME 490
520 FLAG2 = 0
530 IF RAND <= .5 THEN 550
540 RAND = RAND - .5: FLAG2 = 1
550 RC = 2 * ATN(B2 * TAN(PI * RAND - ATN(B1)) + D / TL): REM course in radians relative to the minor axis of
the focusing ellipse
560 ON ERROR GOTO 0
570 IF FLAG2 = 1 THEN RC = PI - RC
580 AL = (TL - D) / (TL - D * SIN(RC)): : REM average leg length for the relative course RC
590 GOSUB 7620
600 ON ERROR GOTO 0
610 FR(I) = RC + S: REM course in radians on leg I
620 TLEGM = (A * A - C * C) / (A - C * SIN(RC)): REM maximum leg length in nautical miles for the relative
course RC
630 IF TLEG >= TLEGM THEN TLEG = TLEGM: FLAG1 = 1: REM track is terminated at the final point
```

```
640 GOSUB 6030
650 LINE (X(I), Y(I))-(X(I - 1), Y(I - 1))
660 A = A1: REM remaining track length in nautical miles
670 C = C1: REM distance between the final point and the end point of the previous leg
680 S = BR - PI / 2: REM direction of the minor axis of the focusing ellipse
690 TLEG(I) = TLEG: REM leg length of leg I
700 IF FLAG1 = 1 THEN 750
710 NEXT I
720 NTR = NTR + 1
730 J = J - 1
740 GOTO 1280: REM track terminated
750 LINE (D / 2, 0)-(X(I), Y(I))
760 NLEG = I + 1: REM number of legs
770 TLEG = 2 * C: TLEG(NLEG) = TLEG
780 H = S + PI / 2: REM bearing in radians of final point from the end point of the leg
790 FR(NLEG) = H: REM course in radians on last leg
800 X(NLEG) = D / 2: REM x-coordinate of final point for all tracks
810 Y(NLEG) = 0: REM y-coordinate of final point for all tracks
820 T(0) = 0
830 FOR I = 1 TO NLEG
840 T = TLEG(I) / V: REM time in hours to traverse leg I
850 T(I) = T(I - 1) + T: REM time in hours from the initial point to the end point of leg I
860 NEXT I
870 XS(0) = -D / 2: YS(0) = 0
880 K = 1: TSK = TS
890 FOR I = 1 TO NLEG
900 IF TSK > T(I) AND I < NLEG THEN 960: REM the next time step point is past the Ith leg
910 TK = TSK - T(I - 1): REM time from the starting point of the Ith leg to the Kth time step point
920 XS(K) = X(I - 1) + V * TK * SIN(FR(I)): REM x-coordinate of the Kth time step point
930 YS(K) = Y(I - 1) + V * TK * COS(FR(I)): REM y-coordinate of the Kth time step point
940 K = K + 1: TSK = TSK + TS: REM next time step
950 IF K > NS THEN 980 ELSE 900
960 NEXT I
970 ERASE X, Y, FR, T, TLEG
980 FOR K = 1 TO NS - 1
990 CIRCLE (XS(K), YS(K)), 8 * SF
1000 NEXT K
1010 IF FLAG5 = 0 THEN 1050
1020 A$ = " ": INPUT "Quit (y/n)"; A$
1030 IF A$ = "N" OR A$ = "n" THEN CLS : GOTO 400
1040 IF A$ = "Y" OR A$ = "y" THEN END ELSE 1020
1050 FOR I = 0 TO NS
1060 FOR L = -LL TO LU
1070 IF (L - 1 / 2) * SL < XS(I) AND XS(I) <= (L + 1 / 2) * SL THEN 1090: REM the x-coordinate of the Ith time
step point is in range L
1080 NEXT L
1090 FOR M = -ML TO MU
1100 IF (M - 1 / 2) * SL < YS(I) AND YS(I) <= (M + 1 / 2) * SL THEN 1130: REM the y-coordinate of the Ith time
step point is in range M
1110 NEXT M
1120 GOTO 1270
1130 MP(L, M, I) = MP(L, M, I) + 1: REM random tour probability map element
1140 IF I > 0 THEN 1170
1150 L0 = L: M0 = M
1160 GOTO 1270
1170 L1 = L: M1 = M
1180 FOR N = -1 TO 1
1190 FOR K = -1 TO 1
1200 IF NOT (L1 = L0 + N AND M1 = M0 + K) THEN 1240
1210 MT(N, K, L0, M0, I - 1) = MT(N, K, L0, M0, I - 1) + 1: REM dynamic diffusion matrix element
1220 MTS(N, K, L0, M0) = MTS(N, K, L0, M0) + 1: REM static diffusion matrix element
1230 GOTO 1260
1240 NEXT K
1250 NEXT N
1260 L0 = L1: M0 = M1
1270 NEXT I
1280 NEXT J
1290 A$ = " ": PRINT : INPUT "display a random tour probability map (y/n)"; A$
1300 IF A$ = "N" OR A$ = "n" THEN 1500
```

```
1310 IF A$ = "Y" OR A$ = "y" THEN 1320 ELSE 1290
1320 SCREEN 0: CLS
1330 PRINT "NS = "; NS
1340 PRINT : INPUT "enter the number of time steps from 0 to NS"; I
1350 IF I < 0 OR I > NS THEN 1340
1360 FOR M = 10 TO -10 STEP -1
1370 X$ = STR$(MP(-9, M, I)): X$ = LTRIM$(RTRIM$(X$)): PRINT X$; TAB(5);
1380 FOR N = -8 TO 8
1390 X$ = STR$(MP(N, M, I)): X$ = LTRIM$(RTRIM$(X$)): PRINT X$; TAB((N + 9) * 4 + 5);
1400 NEXT N
1410 X$ = STR$(MP(9, M, I)): X$ = LTRIM$(RTRIM$(X$)): PRINT X$
1420 NEXT M
1430 A$ = " ": PRINT : INPUT "print the random tour probability map (y/n)"; A$
1440 IF A$ = "N" OR A$ = "n" THEN 1290
1450 IF A$ = "Y" OR A$ = "y" THEN 1460 ELSE 1430
1460 WIDTH LPRINT 130
1470 GOSUB 4880
1480 WIDTH LPRINT 80
1490 GOTO 1290
1500 A$ = " ": PRINT : INPUT "print a random tour probability map (y/n)"; A$
1510 IF A$ = "N" OR A$ = "n" THEN 1610
1520 IF A$ = "Y" OR A$ = "y" THEN 1530 ELSE 1500
1530 SCREEN 0: CLS
1540 PRINT "NS = "; NS
1550 PRINT : INPUT "enter the number of time steps from 0 to NS "; I
1560 IF I < 0 OR I > NS THEN 1550
1570 WIDTH LPRINT 130
1580 GOSUB 4880
1590 WIDTH LPRINT 80
1600 GOTO 1290
1610 A$ = " ": PRINT : INPUT "print all the random tour probability maps (y/n)"; A$
1620 IF A$ = "N" OR A$ = "n" THEN 1680
1630 IF A$ = "Y" OR A$ = "y" THEN 1640 ELSE 1610
1640 WIDTH LPRINT 130
1650 FOR I = 0 TO NS
1660 GOSUB 4880
1670 NEXT I
1680 A$ = " ": PRINT : INPUT "print all the random tour probability maps to a file (y/n)"; A$
1690 IF A$ = "N" OR A$ = "n" THEN 1800
1700 IF A$ = "Y" OR A$ = "y" THEN 1710 ELSE 1680
1710 PRINT : INPUT "input the data file name"; F$
1720 ON ERROR GOTO 1730: GOTO 1740
1730 RESUME 1710
1740 OPEN "O", #1, F$
1750 FOR I = 0 TO NS
1760 GOSUB 7050
1770 NEXT I
1780 CLOSE #1
1790 ON ERROR GOTO 0
1800 ERASE MP
1810 A$ = " ": PRINT : INPUT "display a dynamic transition matrix (y/n)"; A$
1820 IF A$ = "N" OR A$ = "n" THEN 1920
1830 IF A$ = "Y" OR A$ = "y" THEN 1840 ELSE 1800
1840 SCREEN 0: CLS : GOSUB 6480
1850 PRINT : PRINT
1860 FOR K = 1 TO -1 STEP -1
1870 PRINT : PRINT MT(-1, K, L, M, I - 1); TAB(15); MT(0, K, L, M, I - 1); TAB(29); MT(1, K, L, M, I - 1)
1880 NEXT K
1890 PRINT : PRINT : PRINT : PRINT "number of tracks completed = "; NT
1900 PRINT : PRINT "number of tracks terminated = "; NTR
1910 PRINT : GOTO 1810
1920 A$ = " ": PRINT : INPUT "print a dynamic transition matrix (y/n)"; A$
1930 IF A$ = "N" OR A$ = "n" THEN 2100
1940 IF A$ = "Y" OR A$ = "y" THEN 1950 ELSE 1920
1950 SCREEN 0: CLS : GOSUB 6480
1960 A$ = N$ + " dynamic transition matrix": LPRINT A$
1970 LPRINT : LPRINT "transition number = "; I
1980 LPRINT : LPRINT "x = "; L
1990 LPRINT "y = "; M
```

```
2000 FOR K = 1 TO -1 STEP -1
2010 LPRINT : LPRINT ; TAB(15); MT(-1, K, L, M, I - 1); TAB(29); MT(0, K, L, M, I - 1); TAB(43); MT(1, K, L,
M, I - 1)
2020 NEXT K
2030 LPRINT : LPRINT
2040 GOSUB 6130
2050 IF FLAG4 = 0 THEN N = 34 ELSE N = 33
2060 FOR K = 1 TO N
2070 LPRINT
2080 NEXT K
2090 GOTO 1920
2100 A$ = " ": PRINT : INPUT "print nonzero dynamic transition matrices (y/n)"; A$
2110 IF A$ = "N" OR A$ = "n" THEN 2390
2120 IF A$ = "Y" OR A$ = "y" THEN 2130 ELSE 2100
2130 SCREEN 0: CLS
2140 PRINT "NS = "; NS
2150 PRINT : INPUT "enter the transition number from 1 to NS"; I
2160 IF I < 1 OR I > NS THEN 2150
2170 A$ = N$ + " nonzero dynamic transition matrices": LPRINT A$
2180 LPRINT : LPRINT "transition number = "; I: LPRINT
2190 FOR L = -(LL - 1) TO (LU - 1)
2200 FOR M = -(ML - 1) TO (MU - 1)
2210 MAT = 0
2220 FOR N = -1 TO 1
2230 FOR K = -1 TO 1
2240 MAT = MT(N, K, L, M, I - 1) + MAT
2250 NEXT K
2260 NEXT N
2270 IF MAT = 0 THEN 2340
2280 LPRINT : LPRINT "x = "; L
2290 LPRINT "y = "; M
2300 FOR K = 1 TO -1 STEP -1
2310 LPRINT : LPRINT ; TAB(15); MT(-1, K, L, M, I - 1); TAB(29); MT(0, K, L, M, I - 1); TAB(43); MT(1, K, L,
M, I - 1)
2320 NEXT K
2330 LPRINT : LPRINT
2340 NEXT M
2350 NEXT L
2360 LPRINT : LPRINT
2370 GOSUB 6130
2380 GOTO 2100
2390 A$ = " ": PRINT : INPUT "print a dynamic transition matrix to a file (y/n)"; A$
2400 IF A$ = "N" OR A$ = "n" THEN 2630
2410 IF A$ = "Y" OR A$ = "y" THEN 2420 ELSE 2390
2420 SCREEN 0: CLS : INPUT "input the data file name"; F$
2430 ON ERROR GOTO 2440: GOTO 2450
2440 RESUME 2420
2450 OPEN "O", #1, F$
2460 GOSUB 6480
2470 A$ = N$ + " dynamic transition matrix": PRINT #1, A$
2480 PRINT #1, : PRINT #1, "transition number = "; I
2490 PRINT #1, : PRINT #1, "x = "; L
2500 PRINT #1, "y = "; M
2510 FOR K = 1 TO -1 STEP -1
2520 PRINT #1, : PRINT #1, ; TAB(15); MT(-1, K, L, M, I - 1); TAB(29); MT(0, K, L, M, I - 1); TAB(43); MT(1,
K, L, M, I - 1)
2530 NEXT K
2540 PRINT #1, : PRINT #1,
2550 GOSUB 6560
2560 IF FLAG4 = 0 THEN N = 27 ELSE N = 26
2570 FOR K = 1 TO N
2580 PRINT #1,
2590 NEXT K
2600 CLOSE #1
2610 ON ERROR GOTO 0
2620 GOTO 2390
2630 A$ = " ": PRINT : INPUT "generate dynamic diffusion tracks (y/n)"; A$
2640 IF A$ = "Y" OR A$ = "y" THEN 2660
2650 IF A$ = "N" OR A$ = "n" THEN 2770 ELSE 2630
```

```
2660 SCREEN 0: CLS
2670 PRINT "NS = ", NS
2680 PRINT : INPUT "enter the number of diffusions from 1 to NS"; ND
2690 IF ND < 1 OR ND > NS THEN 2680
2700 PRINT : INPUT "enter the number of tracks"; NDT
2710 CLS
2720 GOSUB 4770
2730 FOR J = 1 TO NDT
2740 GOSUB 5050
2750 NEXT J
2760 GOTO 2630
2770 A$ = " ": PRINT : INPUT "generate a dynamic diffusion probability map (y/n)"; A$
2780 IF A$ = "Y" OR A$ = "y" THEN 2800
2790 IF A$ = "N" OR A$ = "n" THEN 3050 ELSE 2770
2800 SCREEN 0: CLS
2810 PRINT "NS = "; NS
2820 PRINT : INPUT "enter the number of diffusions from 0 to NS "; ND
2830 IF ND < 0 OR ND > NS THEN 2820
2840 REDIM MPD(-LL TO LU, -ML TO MU) AS INTEGER
2850 GOSUB 5330
2860 A$ = " ": PRINT : INPUT "display the dynamic diffusion probability map (y/n)"; A$
2870 IF A$ = "N" OR A$ = "n" THEN 2970
2880 IF A$ = "Y" OR A$ = "y" THEN 2890 ELSE 2860
2890 SCREEN 0: CLS
2900 FOR M = 10 TO -10 STEP -1
2910 X$ = STR$(MPD(-9, M)): X$ = LTRIM$(RTRIM$(X$)): PRINT X$; TAB(5);
2920 FOR N = -8 TO 8
2930 X$ = STR$(MPD(N, M)): X$ = LTRIM$(RTRIM$(X$)): PRINT X$; TAB((N + 9) * 4 + 5);
2940 NEXT N
2950 X$ = STR$(MPD(9, M)): X$ = LTRIM$(RTRIM$(X$)): PRINT X$
2960 NEXT M
2970 A$ = " ": PRINT : INPUT "print the dynamic diffusion probability map (y/n)"; A$
2980 IF A$ = "N" OR A$ = "n" THEN 2770
2990 IF A$ = "Y" OR A$ = "y" THEN 3000 ELSE 2970
3000 WIDTH LPRINT 130
3010 GOSUB 5680
3020 WIDTH LPRINT 80
3030 ERASE MPD
3040 GOTO 2770
3050 A$ = " ": PRINT : INPUT "print all the dynamic diffusion probability maps (y/n)"; A$
3060 IF A$ = "N" OR A$ = "n" THEN 3160
3070 IF A$ = "Y" OR A$ = "y" THEN 3080 ELSE 3050
3080 WIDTH LPRINT 130
3090 FOR ND = 0 TO NS
3100 REDIM MPD(-LL TO LU, -ML TO MU) AS INTEGER
3110 GOSUB 5330
3120 GOSUB 5680
3130 NEXT ND
3140 ERASE MPD
3150 WIDTH LPRINT 80
3160 A$ = " ": PRINT : INPUT "print all the dynamic diffusion probability maps to a file (y/n)"; A$
3170 IF A$ = "N" OR A$ = "n" THEN 3310
3180 IF A$ = "Y" OR A$ = "y" THEN 3190 ELSE 3160
3190 PRINT : INPUT "input the data file name"; F$
3200 ON ERROR GOTO 3220
3210 GOTO 3230
3220 RESUME 3190
3230 OPEN "O", #1, F$
3240 FOR ND = 0 TO NS
3250 REDIM MPD(-LL TO LU, -ML TO MU) AS INTEGER
3260 GOSUB 5330
3270 GOSUB 6700
3280 NEXT ND
3290 CLOSE #1
3300 ON ERROR GOTO 0
3310 ERASE MPD
3320 A$ = " ": PRINT : INPUT "display a static transition matrix (y/n)"; A$
3330 IF A$ = "N" OR A$ = "n" THEN 3430
3340 IF A$ = "Y" OR A$ = "y" THEN 3350 ELSE 3320
```

```
3350 SCREEN 0: CLS : GOSUB 6510
3360 PRINT : PRINT
3370 FOR K = 1 TO -1 STEP -1
3380 PRINT : PRINT MTS(-1, K, L, M); TAB(15); MTS(0, K, L, M); TAB(29); MTS(1, K, L, M)
3390 NEXT K
3400 PRINT : PRINT : PRINT : PRINT "number of tracks completed = "; NT
3410 PRINT : PRINT "number of tracks terminated = "; NTR
3420 PRINT : GOTO 3320
3430 A$ = " ": PRINT : INPUT "print a static transition matrix (y/n)"; A$
3440 IF A$ = "N" OR A$ = "n" THEN 3600
3450 IF A$ = "Y" OR A$ = "y" THEN 3460 ELSE 3430
3460 SCREEN 0: CLS : GOSUB 6510
3470 A$ = N$ + " static transition matrix": LPRINT A$
3480 LPRINT : LPRINT "x = "; L
3490 LPRINT "y = "; M
3500 FOR K = 1 TO -1 STEP -1
3510 LPRINT : LPRINT ; TAB(15); MTS(-1, K, L, M); TAB(29); MTS(0, K, L, M); TAB(43); MTS(1, K, L, M)
3520 NEXT K
3530 LPRINT : LPRINT
3540 GOSUB 6130
3550 IF FLAG4 = 0 THEN N = 36 ELSE N = 35
3560 FOR K = 1 TO N
3570 LPRINT
3580 NEXT K
3590 GOTO 3430
3600 A$ = " ": PRINT : INPUT "print all nonzero static transition matrices (y/n)"; A$
3610 IF A$ = "N" OR A$ = "n" THEN 3840
3620 IF A$ = "Y" OR A$ = "y" THEN 3630 ELSE 3600
3630 SCREEN 0: CLS
3640 A$ = N$ + " nonzero static transition matrices": LPRINT A$
3650 FOR L = -(LL - 1) TO (LU - 1)
3660 FOR M = -(ML - 1) TO (MU - 1)
3670 MAT = 0
3680 FOR N = -1 TO 1
3690 FOR K = -1 TO 1
3700 MAT = MTS(N, K, L, M) + MAT
3710 NEXT K
3720 NEXT N
3730 IF MAT = 0 THEN 3800
3740 LPRINT : LPRINT "x = "; L
3750 LPRINT "y = "; M
3760 FOR K = 1 TO -1 STEP -1
3770 LPRINT : LPRINT ; TAB(15); MTS(-1, K, L, M); TAB(29); MTS(0, K, L, M); TAB(43); MTS(1, K, L, M)
3780 NEXT K
3790 LPRINT : LPRINT
3800 NEXT M
3810 NEXT L
3820 LPRINT : LPRINT
3830 GOSUB 6130
3840 A$ = " ": PRINT : INPUT "print a static transition matrix to a file (y/n)"; A$
3850 IF A$ = "N" OR A$ = "n" THEN 4080
3860 IF A$ = "Y" OR A$ = "y" THEN 3870 ELSE 3840
3870 SCREEN 0: CLS : INPUT "input the data file name"; F$
3880 ON ERROR GOTO 3890: GOTO 3900
3890 RESUME 3870
3900 OPEN "O", #1, F$
3910 GOSUB 6510
3920 A$ = N$ + " static transition matrix"
3930 PRINT #1, A$
3940 PRINT #1, : PRINT #1, "x = "; L
3950 PRINT #1, "y = "; M
3960 FOR K = 1 TO -1 STEP -1
3970 PRINT #1, : PRINT #1, ; TAB(15); MTS(-1, K, L, M); TAB(29); MTS(0, K, L, M); TAB(43); MTS(1, K, L, M)
3980 NEXT K
3990 PRINT #1, : PRINT #1,
4000 GOSUB 6560
4010 IF FLAG4 = 0 THEN N = 30 ELSE N = 29
4020 FOR K = 1 TO N
4030 PRINT #1,
```

```
4040 NEXT K
4050 CLOSE #1
4060 ON ERROR GOTO 0
4070 GOTO 3850
4080 A$ = " ": PRINT : INPUT "generate static diffusion tracks (y/n)"; A$
4090 IF A$ = "Y" OR A$ = "y" THEN 4110
4100 IF A$ = "N" OR A$ = "n" THEN 4230 ELSE 4080
4110 SCREEN 0: CLS
4120 PRINT "NS = ", NS
4130 PRINT : INPUT "enter the number of diffusions from 1 to NS"; ND
4140 IF ND < 1 OR ND > NS THEN 4130
4150 PRINT : INPUT "enter the number of tracks"; NDT
4160 CLS
4170 GOSUB 4770
4180 FLAG3 = 1
4190 FOR J = 1 TO NDT
4200 GOSUB 5050
4210 NEXT J
4220 GOTO 4080
4230 A$ = " ": PRINT : INPUT "generate a static diffusion probability map (y/n)"; A$
4240 IF A$ = "Y" OR A$ = "y" THEN 4260
4250 IF A$ = "N" OR A$ = "n" THEN 4520 ELSE 4230
4260 SCREEN 0: CLS
4270 PRINT "NS = "; NS
4280 PRINT : INPUT "enter the number of diffusions from 0 to NS "; ND
4290 IF ND < 0 OR ND > NS THEN 4280
4300 REDIM PDT(-LL TO LU, -ML TO MU)
4310 GOSUB 7220
4320 GOSUB 7550
4330 A$ = " ": PRINT : INPUT "display the static diffusion probability map (y/n)"; A$
4340 IF A$ = "N" OR A$ = "n" THEN 4440
4350 IF A$ = "Y" OR A$ = "y" THEN 4360 ELSE 4330
4360 SCREEN 0: CLS
4370 FOR M = 10 TO -10 STEP -1
4380 X$ = STR$(CINT(PDT(-9, M))): X$ = LTRIM$(RTRIM$(X$)): PRINT X$; TAB(5);
4390 FOR N = -8 TO 8
4400 X$ = STR$(CINT(PDT(N, M))): X$ = LTRIM$(RTRIM$(X$)): PRINT X$; TAB((N + 9) * 4 + 5);
4410 NEXT N
4420 X$ = STR$(CINT(PDT(9, M))): X$ = LTRIM$(RTRIM$(X$)): PRINT X$
4430 NEXT M
4440 A$ = " ": PRINT : INPUT "print the static diffusion probability map (y/n)"; A$
4450 IF A$ = "N" OR A$ = "n" THEN 4230
4460 IF A$ = "Y" OR A$ = "y" THEN 4470 ELSE 4440
4470 WIDTH LPRINT 130
4480 GOSUB 5850
4490 WIDTH LPRINT 80
4500 ERASE PDT
4510 GOTO 4230
4520 A$ = " ": PRINT : INPUT "print all the static diffusion probability maps (y/n)"; A$
4530 IF A$ = "N" OR A$ = "n" THEN 4630
4540 IF A$ = "Y" OR A$ = "y" THEN 4550 ELSE 4520
4550 WIDTH LPRINT 130
4560 FOR ND = 0 TO NS
4570 REDIM PDT(-LL TO LU, -ML TO MU)
4580 GOSUB 7220
4590 GOSUB 5850
4600 NEXT ND
4610 ERASE PDT
4620 WIDTH LPRINT 80
4630 A$ = " ": PRINT : INPUT "print all the static diffusion probability maps to a file (y/n)"; A$
4640 IF A$ = "N" OR A$ = "n" THEN 4760
4650 IF A$ = "Y" OR A$ = "y" THEN 4660 ELSE 4630
4660 PRINT : INPUT "input the data file name"; F$
4670 ON ERROR GOTO 4680: GOTO 4690
4680 RESUME 4660
4690 OPEN "O", #1, F$
4700 FOR ND = 0 TO NS
4710 REDIM PDT(-LL TO LU, -ML TO MU)
4720 GOSUB 7220
```

```
4730 GOSUB 6870
4740 NEXT ND
4750 ERASE PDT
4760 END
4770 XM = 10 * SL: YM = 8 * SL
4780 SCREEN 12
4790 WINDOW (-XM, -YM)-(XM, YM)
4800 CIRCLE (-D / 2, 0), 10 * SF: CIRCLE (D / 2, 0), 10 * SF
4810 FOR M = 0 TO 19
4820 LINE (-XM + (M + 1 / 2) * SL, YM - SL / 2)-(-XM + (M + 1 / 2) * SL, -YM + SL / 2)
4830 NEXT M
4840 FOR M = 0 TO 15
4850 LINE (-XM + SL / 2, YM - (M + 1 / 2) * SL)-(XM - SL / 2, YM - (M + 1 / 2) * SL)
4860 NEXT M
4870 RETURN
4880 A$ = N$ + " random tour probability map": LPRINT A$
4890 LPRINT : LPRINT "number of time steps = "; I: LPRINT
4900 FOR M = 10 TO -10 STEP -1
4910 X$ = STR$(MP(-9, M, I)): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$; TAB(MT);
4920 FOR N = -8 TO 8
4930 X$ = STR$(MP(N, M, I)): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$; TAB((N + 9) * (MT - 1) + MT);
4940 NEXT N
4950 X$ = STR$(MP(9, M, I)): LPRINT X$
4960 NEXT M
4970 GOSUB 6130
4980 GOSUB 6270
4990 LPRINT "cell entry sum = "; SM
5000 IF FLAG4 = 0 THEN N = 22 ELSE N = 21
5010 FOR K = 1 TO N
5020 LPRINT
5030 NEXT K
5040 RETURN
5050 L0 = -D / 2 / SL: M0 = 0: REM initial cell indices
5060 FOR I = 1 TO ND
5070 REDIM MTA(-1 TO 1, -1 TO 1) AS INTEGER
5080 MPSUM = 0
5090 FOR N = -1 TO 1
5100 FOR K = -1 TO 1
5110 IF FLAG3 = 0 THEN 5130
5120 MPSUM = MTS(N, K, L0, M0) + MPSUM: GOTO 5140
5130 MPSUM = MT(N, K, L0, M0, I - 1) + MPSUM
5140 MTA(N, K) = MPSUM
5150 NEXT K
5160 NEXT N
5170 GOSUB 7700
5180 RNU = RAND * MPSUM
5190 FOR N = -1 TO 1
5200 FOR K = -1 TO 1
5210 IF RNU < MTA(N, K) THEN 5260: REM transition from (L0+N,M0+K) to (L0,M0)
5220 NEXT K
5230 NEXT N
5240 ERASE MTA
5250 GOTO 5320
5260 L1 = L0 + N: M1 = M0 + K
5270 LINE (L1 * SL, M1 * SL)-(L0 * SL, M0 * SL)
5280 CIRCLE (L1 * SL, M1 * SL), 8 * SF
5290 L0 = L1: M0 = M1
5300 ERASE MTA
5310 NEXT I
5320 RETURN
5330 REDIM MSUM(-LL TO LU, -ML TO MU, MNS)
5340 FOR I = 0 TO NS - 1
5350 FOR L = -LL TO LU
5360 FOR M = -ML TO MU
5370 FOR N = -1 TO 1
5380 FOR K = -1 TO 1
5390 MSUM(L, M, I) = MT(N, K, L, M, I) + MSUM(L, M, I)
5400 NEXT K
5410 NEXT N
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```
5420 NEXT M
5430 NEXT L
5440 NEXT I
5450 MPD(-D / 2 / SL, 0) = NT: REM initial cell probability factor
5460 IF ND = 0 THEN 5660
5470 FOR I = 1 TO ND
5480 REDIM B(-LL TO LU, -ML TO MU)
5490 FOR L = -(LL - 1) TO (LU - 1)
5500 FOR M = -(ML - 1) TO (MU - 1)
5510 FOR N = -1 TO 1
5520 FOR K = -1 TO 1
5530 IF MSUM(L - N, M - K, I - 1) = 0 THEN 5550
5540 B(L, M) = MT(N, K, L - N, M - K, I - 1) / MSUM(L - N, M - K, I - 1) * MPD(L - N, M - K) + B(L, M)
5550 NEXT K
5560 NEXT N
5570 NEXT M
5580 NEXT L
5590 FOR L = -LL TO LU
5600 FOR M = -ML TO MU
5610 MPD(L, M) = B(L, M): REM dynamic diffusion probability map element
5620 NEXT M
5630 NEXT L
5640 ERASE B
5650 NEXT I
5660 ERASE MSUM
5670 RETURN
5680 A$ = N$ + " dynamic diffusion probability map": LPRINT A$
5690 LPRINT : LPRINT "number of diffusions = "; ND: LPRINT
5700 FOR M = 10 TO -10 STEP -1
5710 X$ = STR$(MPD(-9, M)): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$; TAB(MT);
5720 FOR N = -8 TO 8
5730 X$ = STR$(MPD(N, M)): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$; TAB((N + 9) * (MT - 1) + MT);
5740 NEXT N
5750 X$ = STR$(MPD(9, M)): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$
5760 NEXT M
5770 GOSUB 6130
5780 GOSUB 6340
5790 LPRINT "cell entry sum = "; SM
5800 IF FLAG4 = 0 THEN N = 22 ELSE N = 21
5810 FOR K = 1 TO N
5820 LPRINT
5830 NEXT K
5840 RETURN
5850 A$ = N$ + " static diffusion probability map": LPRINT A$
5860 LPRINT : LPRINT "number of diffusions = "; ND: LPRINT
5870 FOR M = 10 TO -10 STEP -1
5880 X$ = STR$(CINT(PDT(-9, M))): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$; TAB(MT);
5890 FOR N = -8 TO 8
5900 X$ = STR$(CINT(PDT(N, M))): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$; TAB((N + 9) * (MT - 1) + MT);
5910 NEXT N
5920 X$ = STR$(CINT(PDT(9, M))): X$ = LTRIM$(RTRIM$(X$)): LPRINT X$
5930 NEXT M
5940 GOSUB 6130
5950 GOSUB 6410
5960 LPRINT "cell entry sum = "; SM
5970 LPRINT "cell entries are rounded integer"
5980 IF FLAG4 = 0 THEN N = 21 ELSE N = 20
5990 FOR K = 1 TO N
6000 LPRINT
6010 NEXT K
6020 RETURN
6030 X(I) = X(I - 1) + TLEG * SIN(FR(I)): REM x-coordinate of the end of leg I
6040 Y(I) = Y(I - 1) + TLEG * COS(FR(I)): REM y-coordinate of the end of leg I
6050 X = D / 2 - X(I): Y = 0 - Y(I): REM determine the bearing and range of the final point from the end of leg
I
6060 RF = SQR(X * X + Y * Y): REM  range of the final point from the end of leg I
6070 C1 = RF / 2: REM distance of the center of the trial focusing ellipse from the final point
6080 A1 = A - TLEG / 2: REM one-half the remaining track length
6090 IF ABS(X / RF) = 1 THEN BB = PI / 2 * SGN(X) ELSE BB = ATN(X / RF / SQR(1 - X * X / RF / RF))
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6100 IF ABS(Y / RF) = 1 THEN BR = PI / 2 * (1 - SGN(Y)) ELSE BR = PI / 2 - ATN(Y / RF / SQR(1 - Y * Y / RF /
RF))
6110 IF BB < 0 THEN BR = 2 * PI - BR: REM bearing in radians of the final point from the end point of leg I
6120 RETURN
6130 LPRINT : LPRINT "submarine speed in knots = "; V
6140 LPRINT "distance between end points in nautical miles = "; D
6150 LPRINT "length of a cell side in nautical miles = "; SL
6160 LPRINT "time step in hours ="; TS
6170 LPRINT "maximum number of time steps = "; NS
6180 LPRINT "track length in nautical miles = "; TL
6190 LPRINT "delta in nautical miles = "; DEL
6200 LPRINT "leg length distribution index = "; NI
6210 LPRINT "random number generator = "; R$
6220 IF FLAG4 = 0 THEN 6240
6230 LPRINT "random number seed = "; RNS
6240 LPRINT "number of tracks completed = "; NT
6250 LPRINT "number of tracks terminated = "; NTR
6260 RETURN
6270 SM = 0
6280 FOR L = -LL TO LU
6290 FOR M = -ML TO MU
6300 SM = MP(L, M, I) + SM
6310 NEXT M
6320 NEXT L
6330 RETURN
6340 SM = 0
6350 FOR L = -LL TO LU
6360 FOR M = -ML TO MU
6370 SM = MPD(L, M) + SM
6380 NEXT M
6390 NEXT L
6400 RETURN
6410 SM = 0
6420 FOR L = -LL TO LU
6430 FOR M = -ML TO MU
6440 SM = PDT(L, M) + SM
6450 NEXT M
6460 NEXT L
6470 RETURN
6480 PRINT "NS = "; NS
6490 PRINT : INPUT "enter the transition number from 1 to NS"; I
6500 IF I < 1 OR I > NS THEN 6490
6510 PRINT : INPUT "x-coordinate"; L
6520 IF L < -(LL - 1) OR L > (LU - 1) THEN 6510
6530 PRINT : INPUT "y-coordinate"; M
6540 IF M < -(ML - 1) OR M > (MU - 1) THEN 6530
6550 RETURN
6560 PRINT #1, : PRINT #1, "submarine speed in knots = "; V
6570 PRINT #1, "distance between end points in nautical miles = "; D
6580 PRINT #1, "length of a cell side in nautical miles = "; SL
6590 PRINT #1, "time step in hours ="; TS
6600 PRINT #1, "maximum number of time steps = "; NS
6610 PRINT #1, "track length in nautical miles = "; TL
6620 PRINT #1, "delta in nautical miles = "; DEL
6630 PRINT #1, "leg length distribution index = "; NI
6640 PRINT #1, "random number generator = "; R$
6650 IF FLAG4 = 0 THEN 6670
6660 PRINT #1, "random number seed = "; RNS
6670 PRINT #1, "number of tracks completed = "; NT
6680 PRINT #1, "number of tracks terminated = "; NTR
6690 RETURN
6700 A$ = N$ + " dynamic diffusion probability map": PRINT #1, A$
6710 PRINT #1, : PRINT #1, "number of diffusions = "; ND: PRINT #1,
6720 FOR M = 10 TO -10 STEP -1
6730 X$ = STR$(MPD(-9, M)): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$; TAB(MT);
6740 FOR N = -8 TO 8
6750 X$ = STR$(MPD(N, M)): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$; TAB((N + 9) * (MT - 1) + MT);
6760 NEXT N
6770 X$ = STR$(MPD(9, M)): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$
```

```
6780 NEXT M
6790 GOSUB 6560
6800 GOSUB 6340
6810 PRINT #1, "cell entry sum = "; SM
6820 IF FLAG4 = 0 THEN N = 16 ELSE N = 15
6830 FOR K = 1 TO N
6840 PRINT #1,
6850 NEXT K
6860 RETURN
6870 A$ = N$ + " static diffusion probability map": PRINT #1, A$
6880 PRINT #1, : PRINT #1, "number of diffusions = "; ND: PRINT #1,
6890 FOR M = 10 TO -10 STEP -1
6900 X$ = STR$(CINT(PDT(-9, M))): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$; TAB(MT);
6910 FOR N = -8 TO 8
6920 X$ = STR$(CINT(PDT(N, M))): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$; TAB((N + 9) * (MT - 1) + MT);
6930 NEXT N
6940 X$ = STR$(CINT(PDT(9, M))): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$
6950 NEXT M
6960 GOSUB 6560
6970 GOSUB 6410
6980 PRINT #1, "cell entry sum = "; SM
6990 PRINT #1, "cell entries are rounded integer"
7000 IF FLAG4 = 0 THEN N = 16 ELSE N = 15
7010 FOR K = 1 TO N
7020 PRINT #1,
7030 NEXT K
7040 RETURN
7050 A$ = N$ + " random tour probability map": PRINT #1, A$
7060 PRINT #1, : PRINT #1, "number of time steps = "; I: PRINT #1,
7070 FOR M = 10 TO -10 STEP -1
7080 X$ = STR$(MP(-9, M, I)): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$; TAB(MT);
7090 FOR N = -8 TO 8
7100 X$ = STR$(MP(N, M, I)): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$; TAB((N + 9) * (MT - 1) + MT);
7110 NEXT N
7120 X$ = STR$(MP(9, M, I)): X$ = LTRIM$(RTRIM$(X$)): PRINT #1, X$
7130 NEXT M
7140 GOSUB 6560
7150 GOSUB 6270
7160 PRINT #1, "cell entry sum = "; SM
7170 IF FLAG4 = 0 THEN N = 16 ELSE N = 15
7180 FOR K = 1 TO N
7190 PRINT #1,
7200 NEXT K
7210 RETURN
7220 REDIM MSUMS(-LL TO LU, -ML TO MU)
7230 FOR L = -LL TO LU
7240 FOR M = -ML TO MU
7250 FOR N = -1 TO 1
7260 FOR K = -1 TO 1
7270 MSUMS(L, M) = MTS(N, K, L, M) + MSUMS(L, M)
7280 NEXT K
7290 NEXT N
7300 NEXT M
7310 NEXT L
7320 PDT(-D / 2 / SL, 0) = NT: REM initial cell probability factor
7330 IF ND = 0 THEN RETURN
7340 FOR I = 1 TO ND
7350 REDIM B(-LL TO LU, -ML TO MU)
7360 FOR L = -(LL - 1) TO (LU - 1)
7370 FOR M = -(ML - 1) TO (MU - 1)
7380 FOR N = -1 TO 1
7390 FOR K = -1 TO 1
7400 IF MSUMS(L - N, M - K) = 0 THEN 7420
7410 B(L, M) = MTS(N, K, L - N, M - K) / MSUMS(L - N, M - K) * PDT(L - N, M - K) + B(L, M)
7420 NEXT K
7430 NEXT N
7440 NEXT M
7450 NEXT L
7460 FOR L = -LL TO LU
```

```
7470 FOR M = -ML TO MU
7480 PDT(L, M) = B(L, M): REM static diffusion probability map element
7490 NEXT M
7500 NEXT L
7510 ERASE B
7520 NEXT I
7530 ERASE MSLMS
7540 RETURN
7550 SM = 0
7560 FOR L = -LL TO LU
7570 FOR M = -ML TO MU
7580 SM = PDT(L, M) + SM
7590 NEXT M
7600 NEXT L
7610 RETURN
7620 TLEG = 0
7630 FOR L = 1 TO NI
7640 GOSUB 7700
7650 ON ERROR GOTO 7660: GOTO 7670
7660 RESUME 7640
7670 TLEG = -DEL * AL * LOG(1 - RAND) / NI + TLEG: REM trial leg length generator for the relative course RC
7680 NEXT L
7690 RETURN
7700 IF R$ = "standard" THEN RAND = RND ELSE GOSUB 7810: REM auxiliary random number generator subroutine branch
7710 RETURN
7720 R$ = "auxiliary": REM the first line of an auxiliary random number generator setup subroutine
```

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